

## **Some questions to be answered for an atmospheric monitoring program:**

### **1. *What pollutants do you try to measure?***

- . What pollutants are causing a problem?
- . What pollutants are suspected of causing a problem?
- . What pollutants do you need to measure to assess whether a potential problem may exist?
- . Do adequate techniques for quantifying concentrations exist for the levels anticipated?
- . Caution: don't just assume you'll only measure what is "always" measured...
- . Be careful with cost accounting in your decisions, i.e., distinguish between analytical costs and other sampling costs – i.e., don't assume you can't include "analytically expensive" pollutants, as the total cost for sampling these may not be that much more than for "cheaper" pollutants.

### **2. *What are you going to try to use the monitoring data for?***

- . Screening level assessment of magnitude of problem?
- . Trend analysis?
- . A source of data for back-trajectory calculations?
- . A comprehensive modeling analysis (monitoring data are used for model evaluation)

### **3. *What atmospherically relevant media? (air (gas and/or particles), size resolved measurements for particulate? precipitation, fog, passive media (e.g., pine needles...)***

- . What media are significant concentrations expected in?
- . What are the relative costs of monitoring for the pollutant in different media
- . How easy will it be to use the information later (passive media may be more difficult)

### **4. *How long do you sample for (1 hour samples?, 1 day samples?, 1 month samples?, etc.)***

- . How long do you have to sample for to get measurable amounts?
- . How long will analyte be stable in sampling system?
- . Short-term samples better for back-trajectory analyses...

### **5. *Are sample periods continuous or sporadic, e.g., 1 day every month, or every day? If sporadic, what is frequency of sampling?***

- . If sporadic, may not get good answer for average concentrations.
- . If sporadic, may miss episodic phenomenon
- . If continuous, may cost too much...
- . Which is better: one 1-day sample per month or one 30-day sample per month? It depends...

### **6. *Where do you sample? How many locations?***

- . What spatial gradients exist or are expected?
- . Are there existing sampling sites that can be "exploited" (e.g., power already provided, etc.)
- . Adequate "fetch"; representative of general area?

### **7. *Ground level samples only, or elevated samples?***

- . Are dramatic vertical gradients expected? Do you need to know them?
- . Most samples are at ground level (~ 2 meters height)... Costs more for tower samples; aircraft samples even more expensive

### **8. *What else should you measure to help you interpret what you get?***

- . Meteorological conditions at the site (temperature, precipitation, wind speed, wind direction...)
- . Total particulate matter
- . Other pollutants and/or compounds (e.g., ozone, crustal elements, other tracers, etc.)

### **9. *What quality control and quality assurance steps need to be taken?***

- . Very important – if there are problems, you want to know right away...
- . Field and laboratory procedures... (spikes, blanks...)

## ***QUESTIONS to SPEAKERS***

### ***1. Why care about air toxics deposition and accumulation in park ecosystems?***

- . For some toxics, atmospheric deposition may be a significant or even the most significant loading pathway into a given park ecosystem.

### ***2. Effects of air toxics (and at what concentrations)?***

- . Data are very limited, because we haven't looked all that hard for most compounds. However, ecosystems contamination by mercury, dioxin, PCB's and PAH's (these are examples – there are others) are probably mostly driven by the atmospheric pathway...

### ***3. Air toxics distribution and effects in the western US?***

- . Why limit discussion to western U.S.?
- . Data are very limited; we don't know all that much yet...

### ***4. Recommendations for monitoring of air toxics in specific media in parks?***

- . Measure a range of toxics in a variety of media, especially at the top of the food chain. Conduct screening level risk-assessments to find out which compounds are most likely to be causing adverse effects in park ecosystems...

### ***5. "Advance work" before an air toxics monitoring plan can be devised?***

- . Air toxics monitoring can proceed in stages. Screening level analyses can begin by measuring a suite of compounds in the atmosphere in a variety of locations
- . Using these data and data on concentrations in various media (including biota), develop plan to measure the most important compounds at a sufficient number of locations to characterize the problem

### ***6. What trends can we predict in toxic emissions, deposition and impacts?***

- . Emissions trends hard to assess, because emissions inventories (U.S., elsewhere) are of poor quality. Some pollutants may be increasing, some decreasing...
- . Deposition trends should follow emissions trends (more or less) (can be a lag due to grasshopper effect)
- . Impacts can be further lagged behind emissions and deposition trends due to accumulation in sediments, soil, or other ecosystem "reservoirs"

### ***7. What do we need to know – research and knowledge gaps?***

- . Which compounds are causing problems in the parks?
- . Of these, how important is the atmospheric pathway?
- . Temporally and geographically resolved emissions inventories
- . Atmospheric fate and transport behavior of these compounds?
- . Relative importance of different sources and source regions?
- . Technical and economic options for reducing or eliminating these emissions?